[JP,06-097567,B]

CLAIMS

[Claim(s)]
[Claim 1] Dielectric object; and polymer **** embedded to this dielectric inside of the body;
** -- since -- a part for the aromaticity configuration in which this polymer **** contains at least one of Si and the germanium atoms -- containing --;
This polymer **** contains the bridge formation-ized agent chosen from the group of one sort or several sorts of metal cyclobutane radicals, and a metal vinyl group.;
This cyclobutane radical and this vinyl group are the structure which is a thing containing at least one of Si and the germanium atoms.
[Claim 2] this dielectric body was embedded into it -- electric -- the structure according to claim 1 which is what contains a conductor further.
[Claim 3] this -- electric -- a conductor -- the structure according to claim 2 which is what contains further the electronics components electrically connected to the inner conductor pattern.
[Claim 4] The 1st layer of a dielectric ingredient is prepared.;
On this ingredient layer, the liquid polymer nature ingredient containing a constituted part of aromaticity containing at least one of Si and the germanium atoms is arranged.;
This liquid polymer nature ingredient contains the bridge formation-ized agent chosen from the group of one sort or several sorts of metal cyclobutane radicals, and a metal vinyl group.;
This metal cyclobutane ring and this vinyl group contain at least one of Si and the germanium atoms.;
The crosslinking bond of this liquid polymer is carried out.;

The 2nd dielectric layer is arranged on this bridge-formation-ized liquid polymer.; this -- the 1st -- and -- this --; on which a pattern shall be etched into with the plasma which contains oxygen for one of the 2nd dielectric layer, and this bridge-formation-ized polymer shall act as dirty barrier at this time
The creation approach of the structure which consists of things.
[Claim 5] this -- the 1st -- and -- this -- as electric as at least one patternizing of the 2nd dielectric layer -- restoration of this pattern by the conductor -- further -- containing -- this liquid polymer nature ingredient -- this -- the 1st -- and -- this -- deposition is carried out to this patternizing in at least one of the 2nd dielectric layer in it -- this -- electric -- the approach according to claim 4 of being what is filled up with the gap between conductors on parenchyma.
[Claim 6] In advance of processing of this liquid polymer nature ingredient, this dielectric layer is the approach according to claim 4 of being what is processed by the steam plasma.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
Field-of-the-invention this invention on industry relates to the dielectric structure by which the polymer nature ingredient which has resistance in reactive ion etching (RIE) is embedded in it. Especially this invention relates to the polyimide structure for electronics. this invention is embedded in it in more detail -- electric -- resistance is in a conductor and reactive ion etching, and thermal stability is related with the electric high polyimide structure for electronics which has the layer of the polymer which can be filled up with the gap between a conductor and the polyimide structure. On the occasion of application of the background electronics of invention, the polymer structure of a multi-level came to be increasingly used as the surface metalization structure of a semiconductor chip, the base for a semiconductor chip package, and the independent structure for electric internal connection of a semiconductor chip to a semiconductor chip base. Since it can make regardless of the structure arranged on it, the polymer structure of these multi-levels is used. For example, a semiconductor chip or a semiconductor chip package base can be made on the level which has the electric conductor pattern for terminals defined beforehand. The polymer structure of a multi-level is made so that it may have an electric conductor pattern corresponding to a chip or the electric conductor pattern for terminals of a base on the 1st side. On

the 2nd side of the multi-level polymer structure, the conductor patterns various kinds of terminals, for I/O, etc. can be made. A semiconductor chip or a semiconductor chip package base is performed easily, and cheap individualization is attained by fitting the 1st side of the multi-level polymer structure on a chip or a base. A semiconductor chip package base is made from the ceramic ingredient which has a multi-level conductor pattern in it. electric [in the best level] -- to the terminal for I/O of the semiconductor chip attached on it, since a base is connected internally electrically, a conductor is used. Then, the best level needs an electric conductor pattern still thicker than other level in a base. The pattern of detailed magnitude can be made from a polymer ingredient rather than a ceramic ingredient. then, a multi-level -- from what can be made from the ceramic ingredient of a ceramic semiconductor chip base, use of the polymer structure of a conductor approaches far, and has a smaller dimension -- electric -- the metal layer for terminals of the semiconductor chip package base which has a conductor is made possible.
The polymer structure of a multi-level is made by preparing the 1st polymer layer using the standard RISOGURAFU technique which forms the pattern of a through tube of filling up with an electric conductor ingredient into it. Besides, it adheres to the 2nd polymer layer. A resist-like ingredient is given on this 2nd polymer layer, and a resist-like ingredient is developed and patternized in the area where the 2nd polymer layer was exposed. etching with the chemical area of the polymer carried out in this exposure, reactant ion (RIE), or the plasma -- it sleeps together by dry etching which is dirty. RIE and plasma etching are consent words for this purpose. RIE etching is the desirable etching method in order to form the pattern which gives a linear side attachment wall with the pattern which slept together in the polymer layer, then has a smaller dimension. RIE etching penetrates the 2nd polymer layer and arrives at the up front face of the 1st polymer layer. Time amount can be defined in order to stop RIE etching in the suitable depth. The time amount of RIE etching produces the various depth to the pattern which sleeps together. Fluctuation of the depth becomes settled with the precision of etching time, and becomes settled by change of the conditions of RIE etching similarly. Fluctuation of the depth of etching can be removed if the RIE dirty barrier is between the 1st and the 2nd polymer layer. RIE etching of the pattern is carried out in the 2nd polymer layer, and when this RIE etching is suspended by the dirty barrier, the depth of etching is controlled correctly.
Limitation is not carried out to the RIE dirty barrier by which this invention is embedded in a polymer ingredient, but it can apply to such barrier generally embedded into a dielectric ingredient.

One of the purposes of this invention is offering the dielectric object (dielectric body) which has the RIE dirty barrier currently embedded in it.
The polymer structure (polymer structure) of the multi-level used for electronics has been repeated by temperature high in comparison, for example, the temperature which exceeds 400 degrees. Then, the RIE [which is arranged in the polymer structure of a multi-level] dirty barrier must have high thermal stability.
The purpose of this invention is offering the polymer object (polymer body) which has the RIE dirty barrier currently embedded in it.
Another purpose of this invention is providing use of electronics with the useful polymer object (polymer body) which has the embedded RIE dirty barrier.
Another purpose of this invention is offering the polymer object with the embedded RIE dirty barrier which has high thermal stability.
when the deposition of the electric conductor ingredient was carried out to the pattern etched into the dielectric layer, it was formed the side attachment wall of the pattern in a dielectric layer, and into it -- electric -- space is generated between conductors. Such space will give the location which is produced during processing of a base and which a contamination accumulates. The contamination of ionicity produces the short-circuit during electric wiring, and makes it disconnect by producing the corrosion of wiring. In order to avoid these effects that are not desirable, to be filled up with such space or a gap is desired.
the deposition of the RIE dirty barrier by this invention is carried out as a polymer of liquid nature, and this is electric -- it has viscosity sufficient in the gap between the patterns into which it was etched in the conductor and the dielectric ingredient, although a polymer can flow. This liquid polymer is hardened after that in order to bridge-formation-ize a polymer so that it may be in a solid condition.
the purpose of this invention is electric -- it is offering the polymer nature ingredient filled up with the gap between a conductor and the dielectric object with which it is embedded. The polymer nature ingredient by this invention can act on coincidence as RIE dirty barrier, and it can be filled up with the gap produced from a copolymer, and has the stability of temperature with one [high] of the unit in it, and one unit can carry out bridge formation-ization of a polymer now.
Another purpose of this invention is offering the polymer nature ingredient which has the component of high temperature oxidation stability, and the component to which a crosslinking bond's is carried out.
RIE dirty ********** is carried out at RIE etching of the base for electronics including oxygen. a well-known ingredient which this contractor invents -- the oxygen

RIE from various infelicity, or the plasma -- it receives dirtily and serious active jamming will be carried out. These have the high viscosity to which the capacity for being filled up with a gap is reduced in the condition of a liquid, and these have the low thermal stability in which the use under the repetition environment of high temperature as which resistance is low required of the interlayer in the dielectric structure for electronics from the oxygen plasma is impossible. It is the non-solvent which the RIE dirty barrier ingredient by this invention has low viscosity, and decrease in number the problem of the contraction in the case of hardening, and many aforementioned problems are conquered by having high etching resistance about the dielectric body etc.

In the main point of invention, but the standpoint of a wide sense, this invention is a thing about the dielectric body with which it fills up with polymer **** which is the barrier to reactive ion etching in it.

In a specific standpoint, the polymer dirty barrier object of this invention is the thing of the form in which the copolymer which contained the cross-linking component chosen from the cyclobutane radical and the vinyl group, including an aromatic series component with high thermal stability including silicon, germanium, or transition metals carried out the crosslinking bond.

In a further specific standpoint, the aromatic series component with the high thermal stability of this invention is chosen from the group of the naphthalene which is not permuted [a permutation or], anthracene, an ADAMANCHIBU radical, a FERESE rucksack radical, and a carborane radical.

In a further specific standpoint, polymer **** of this invention is a polyimide object.

in still more nearly another specific standpoint, polymer **** of this invention is electric -- the conductor is embedded in it.

the dielectric to which polymer **** of this invention is extended in still more nearly another specific standpoint towards the barrier etched with reactant ion -- it has at least one hole in the living body.

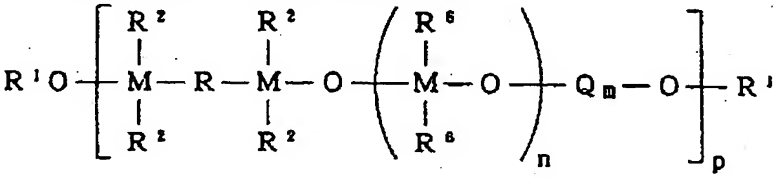
in still more nearly another specific standpoint, the hole of this invention is electric -- it fills up with the conductor.

still more nearly another specific standpoint -- setting -- the RIE dirty barrier ingredient of this invention -- a dielectric -- as electric as the side attachment wall of puncturing in the living body -- a conductor -- the gap of a between is buried.

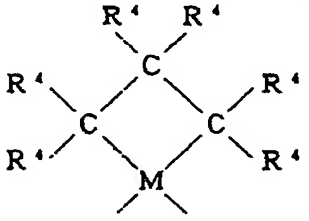
in still more nearly another specific standpoint, it was embedded into [of this invention] it -- electric -- the dielectric body with a conductor is a base with which electronics components are electrically attached on it.

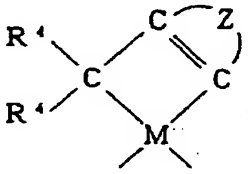
in still more nearly another specific standpoint, it was embedded into [of this invention] it -- electric -- the polymer object with a conductor is the metalization maximum top face of electronics components.

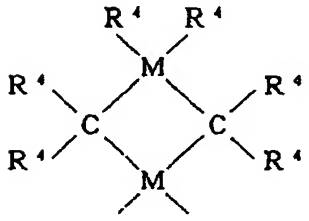
In still more nearly another specific standpoint, the copolymer of this invention has the following structure expression. :

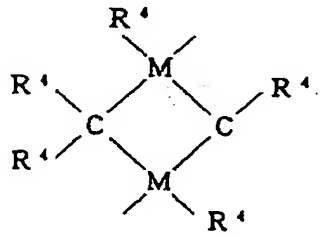


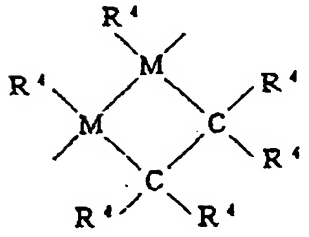
It is here and Q is the following structure expressions.

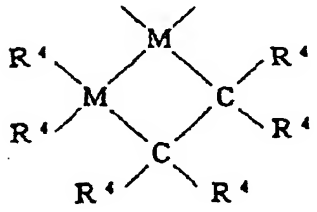


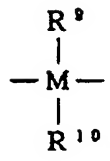






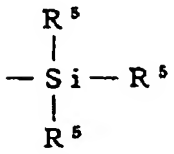




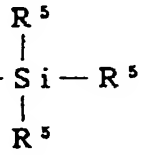


It is chosen out of the group of ****** and :R is a divalent aromatic series radical.;

R1 is H, a univalent hydrocarbon group, and the following structure expression.



it chooses out of the group which consists of a ** silyl radical -- having -- : -- every -- R2 is chosen from H, univalent vinyl and an alkyl group, and the group that consists of alkyl, alkenyl, and an aryl group preferably -- having --;
every -- R4 -- H, a univalent hydrocarbon group, and the following structure



expressions

it chooses out of the group which consists of a ** silicon content radical -- having -- : --; whose R4 is an organic radical desirable and bigger than methyl or methyl to the cyclobutane radical Q containing M atom which adjoins here
every -- R5 is chosen from the group which consists of H, an alkyl group, and an aryl group -- having --;
every -- R6 is chosen from a univalent hydrocarbon group and the group which consists of alkyl and an alkenyl radical preferably -- having --;
R9 is chosen from univalent hydrocarbon groups.;
R10 is chosen from alkenyl radicals.;
Z is chosen from the group which consists of an aromatic series radical which are phenylene, naphthalene, and anthracene preferably, two R4 joins together and Z forms the ring of 6 members.;
M is chosen each from the group which consists of Si and germanium.;
;m is at least 1, p is a number for a compound to come to have about 1,000 - about 30,000 molecular weight here, and they are [; and n are equal to 0, or] a larger number than this.
Other purposes, descriptions, and effectiveness will become clear from these still more detailed explanation of the example in which reach and the following is desirable, and an attached drawing.
The process which makes the structure by this invention from concrete Fig. 1 of explanation to Fig. 9 is ******(ed).

In Fig. 1 , the dielectric layer 2 has the through tube 4 to be made there. the hole by the usual approach, for example, wet etching, that the through tube is used conventionally, dry etching, and punch and a drill -- dawn -- in addition, it is made more. In order to make a through tube, when using wet or dry-type etching, a resist-like ingredient is given on one field of the dielectric layer 2. This resist-like layer is the photoresist by the zip lei company, for example, AZ type photoresist, typically. The pattern which the photoresist was exposed to electromagnetic radiation, for example, light, through the mask, and was exposed is developed after that. The area where the dielectric layer was exposed is carried out in wet or dry-type etching, in order to sleep a through tube 4 together subsequently to the inside of the dielectric layer 2.

As shown in Fig. 2 , the deposition of the electrical conductivity layer 6 is carried out on the front face 8 of a dielectric layer where Fig. 1 was patternized.

As shown in Fig. 3 , the front face 10 of the electrical conductivity layer 6 sleeps together by the well-known approach conventionally, and is removed, the through tube 4 filled with the electrical conductivity ingredient 10 remains in the front face 8 of the dielectric layer 2, and the electric conduction way 12 is formed.

As shown in Fig. 4 , the RIE dirty barrier layer 14 is arranged on the front face 8 of a polymer layer 2.

As shown in Fig. 5 , the 2nd dielectric layer 16 is arranged on the RIE dirty layer 14. By the well-known approach, a resist-like ingredient is given on the front face 18 of the dielectric layer 16. This resist-like ingredient is a photoresist typically, this is exposed to electromagnetic radiation, for example, a visible ray, and a pattern is formed into a photoresist. This pattern is developed, on a front face 18, leaves a photoresist mask and is removed. the area exposed in the dielectric layer 16 -- subsequently -- RIE -- dirty or the plasma -- it is exposed dirtily, and this attacks the area where the dielectric layer 16 was exposed, etches it through the dielectric layer 16 to the RIE dirty barrier 14, and as shown in Fig. 6 , it forms a pattern 20 into the dielectric layer 16. this application sake -- RIE -- being dirty -- the plasma -- it is a synonym as it is dirty. Below, the area 22 where the RIE dirty barrier layer 14 was exposed is described, and is made and removed. The obtained structure which is shown in the 7th [**] Fig. R> Fig. has pattern 20' which penetrates the dielectric layer 16, and the exposure front face 22 of the electric conduction pattern 12 in the dielectric layer 2.

As shown in Fig. 8 , the deposition of the 2nd electric conduction layer 24 is carried out on the front face 26 of this structure of Fig. 7 . The deposition of the electric

conduction layer 24 can be carried out by the approach of one of common knowledge like spatter composure, chemical steamy composure, electroplating, electroless deposition, and others. Etchback of this electric conduction layer 24 is carried out to the front face 26 of the dielectric layer 16 so that the structure shown all over the 9th Fig. may be obtained.

In Fig. 9 , pattern 20' which penetrates the dielectric layer 16, and the RIE dirty barrier 14 filled by the electric conduction material 28 are shown, and the electric conduction material 28 touches as electrically as the electric conduction material 12 in the through tube 4 of the dielectric layer 2.

By repeating each process of the 1st – 9 Fig., it will be understood for this contractor that the structure with a number like a dielectric layer and an electric conduction material layer throat can also be made. It was explained that manufacture of the structure of Fig. 9 makes one dielectric layer a dielectric layer with an electric conduction way and now which has a conductor. It can make by the approach which described the thing of any numbers of a layer with an electric conduction way, electric conduction objects, or such combination here.

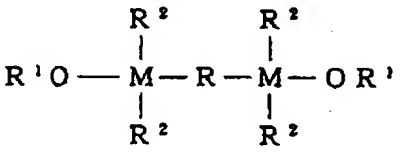
It is a thing only for explanation with the approach and structure where it explained with reference to Fig. 1–9, and limitation is not carried out to this.

The dielectric ingredients the layer 2 of the structure of Fig. 9 and for 16 are a ceramic and a polymer. A polymer is desirable with a dielectric ingredient and the most desirable thing is polyimide. What kind of electrical conductivity ingredient is sufficient as the electric conduction ingredient used in order to form the electric conduction ways 12 and 28. A desirable electric conduction ingredient is a metal and the most desirable things are copper, aluminum, molybdenum, chromium, gold, silver, these alloys, etc. RIE dirty ** used in order to make a pattern in a dielectric layer —— oxygen is included preferably. But it is desirable RIE or plasma dirty ** O2, and O2/CF4. Although the dielectric layer in the structure of Fig. 9 may have what kind of thickness, desirable thickness is about 1micro to about 10micro. Although the RIE dirty barrier can also have what kind of thickness, desirable thickness is about 0.2micro to about 1micro. The RIE dirty barrier ingredient of Fig. 9 is a copolymer containing a part with high thermal stability, and the part which can carry out other molecules and crosslinking bonds of a copolymer. As a liquid copolymer, the deposition of the RIE dirty barrier layer 14 is carried out on the front face 8 of Fig. 4 , and it is stiffened after that so that a bridge may be constructed over the polymer for forming the RIE dirty barrier layer 14. This liquid copolymer had about 1000 – about 30,000 molecular weight, and has given the viscosity low enough with which a liquid

polymer can flow into the gap 30 between the electric conduction objects and the side attachment walls 32 of the through tube 4 of the dielectric layer 2 like 12 which are shown in Fig. 10.

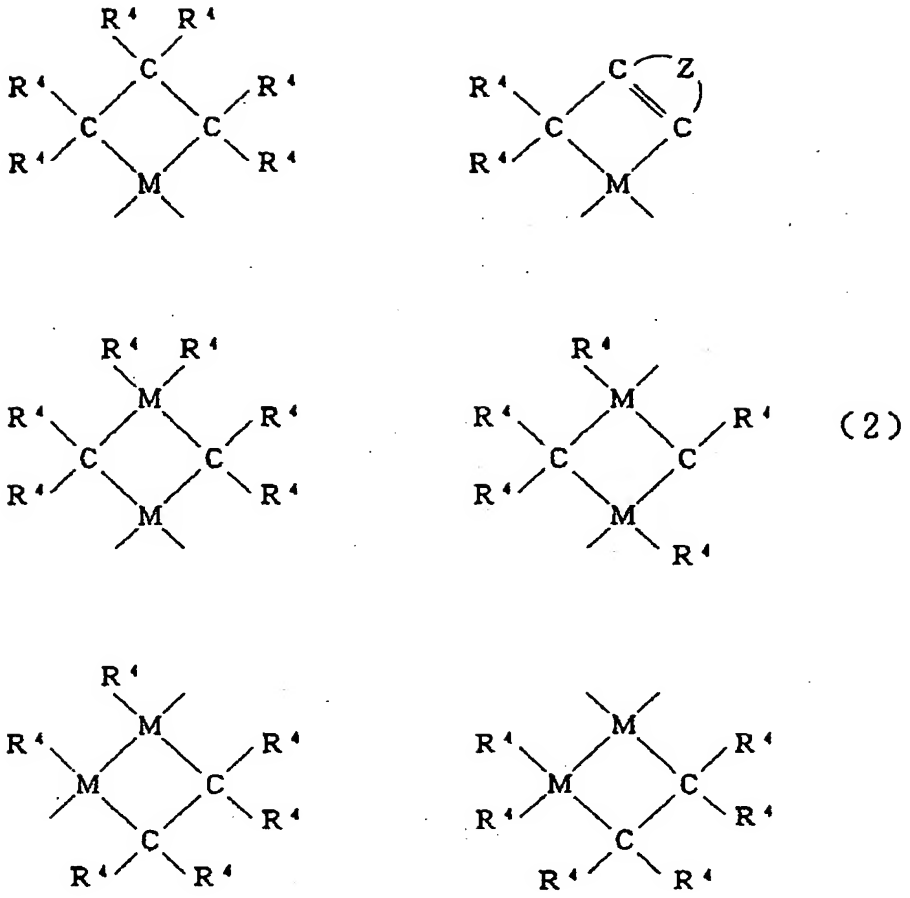
Since the gap between electric conduction material and a dielectric layer serves as a location covered with a contamination in the structure of Fig. 10, as for this gap, it is desirable to be filled up. the polymer for photoresists used during each chemical which used these contaminants during processing of the structure of Fig. 10, that of RIE etching or **, or processing -- similarly they are other those of an ingredient, **, etc. a pollutant generates ion and, originally this is separated -- electric -- a conductor -- in between, short-circuit is produced or it is embedded -- electric -- it becomes the cause of making a conductor corroding.

It is the disilyl or the JIGERUMA substituted compound which has the high thermal stability of the structure expression showing the liquid copolymer precursor of the RIE dirty barrier 14 of Fig. 9 below according to this invention. :



(1)

Cyclobutane of the following structure expressions :



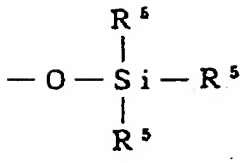
(2)

It is formed by making it react.

M is chosen each from silicon and germanium here.;

R is a divalent aromatic compound here, it was chosen out of the group which consists of a carborane radical which is not permuted [the ferrocene radical which is not permuted / the ADAMANCHIN radical which is not permuted / the anthracene radical which is not permuted / the naphthalene radical which is not permuted / the phenyl group which is not permuted / a permutation or /, a permutation, or /, a permutation, or /, a permutation, or /, a permutation, or /, a permutation, or] preferably, and the most desirable divalent radical is a non-permuted phenyl group.;

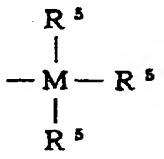
; which R1 is the univalent radical chosen from the group of hydrogen, alkyl, aryl, and the alkenyl, and is hydrogen preferably -- every -- : which R2 is the univalent radical chosen from the group which consists of hydrogen, alkyl, aryl, an alkenyl radical, and a siloxy radical, R2 is methyl preferably and is the siloxy radical which has the following



(3)

structure expressions again

here -- every -- R5 is chosen from the group which consists of an alkyl group, an aryl group, and an alkenyl radical -- having --; -- every -- R4 -- hydrogen, an alkyl group,



an aryl group, an alkenyl radical, and the following structure expressions

It is chosen out of the group which consists of a ** silyl radical, :R4 are an alkyl group preferably, and it is a methyl group most preferably.;

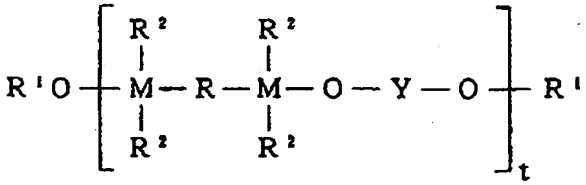
Z can be chosen from an aromatic series radical and the group which consists of the phenylene which is not permuted [a permutation and], naphthalene, and anthracene preferably here, Z can form the ring of 6 members with two R4 combined with this, Z can become for example, -R15 C=R16 C-R17 C=R18C- in this case, and R15, R16, R17, and R18 are organic radicals here.;

R5 is the univalent radical chosen from aryl, alkyl, an alkenyl radical, etc.;

M is chosen from the group which consists of silicon and a germanium atom.;

X is the anion nature residue chosen from the group which consists of halogen ion, and the most desirable thing is chloride ion.

The copolymer in which it is mixed with the cyclobutane compound of a formula 2 with the deHCl agent of twice [about] molar quantity, for example, a pyridine, triethylamine, and permutation amines, and the permutation aromatic compound of the formula 1 of an equimolecular amount has the following structure expressions mostly in a solvent generates. :



(4)

Y is one of the divalent radicals of a formula 2 here.

Typical solvents are toluene, a xylene, a jig lime, amyl acetate, a tetrahydro furan, etc.

The value of t is decided according to desired molecular weight. Depending on a

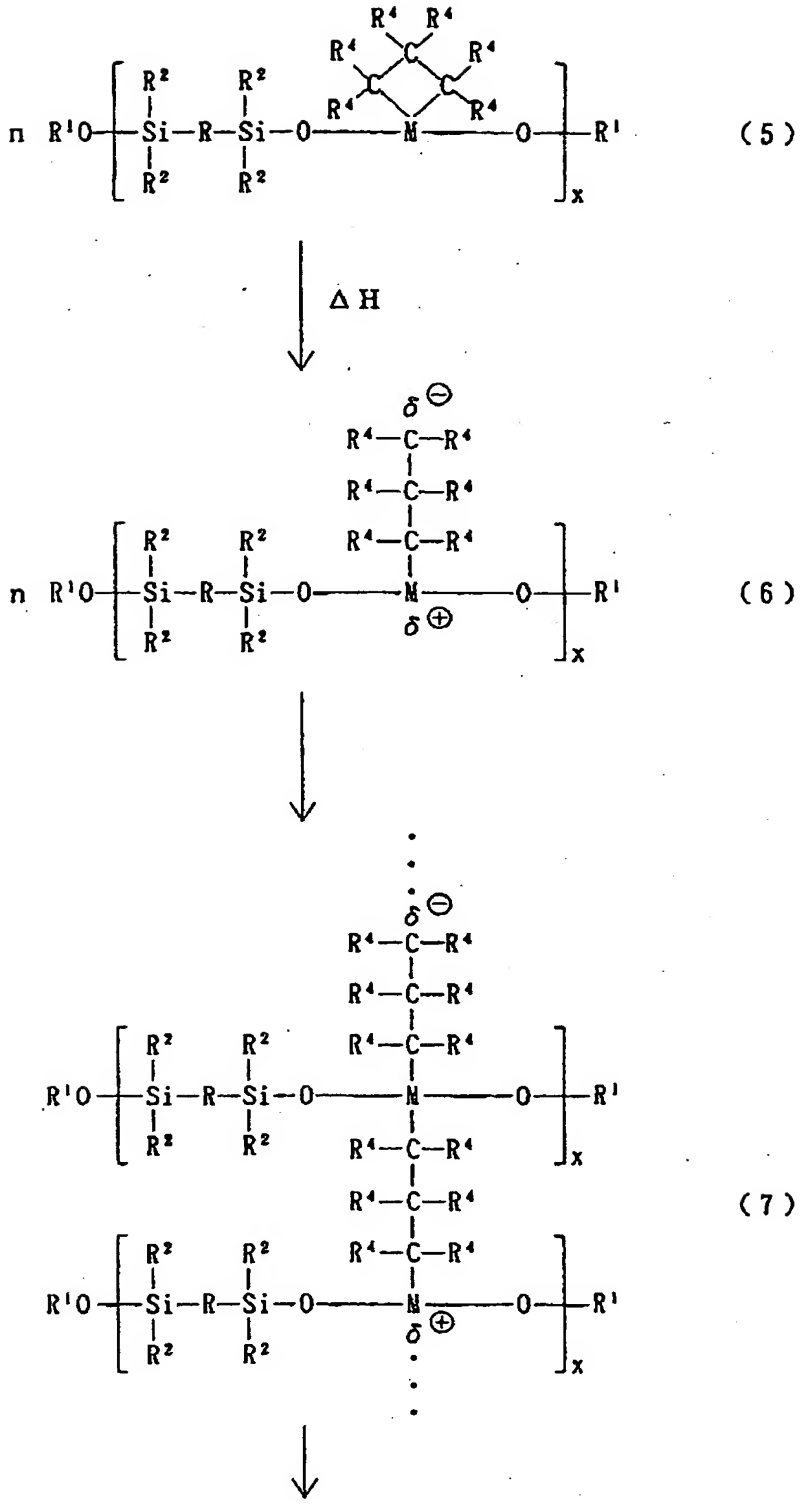
reaction condition, the molecular weight of the condensation product of a formula 4 is adjusted, as it is in the range of the liquid oligomer of about 1000 to about 30,000. It will be understood by this contractor that molecular weight can be adjusted with the type of the type of a deHCl agent, reaction time, and a solvent, the concentration of each component, etc.

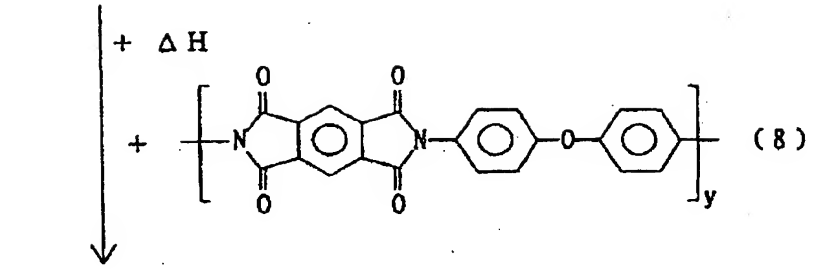
In the structure of this oligomer (formula 4), this makes thermal or the insoluble product which carried out the crosslinking bond of the catalyst-polymerization from the condensate of a lifting and a formula 4 including a reactant METARO cyclobutane ring. A catalyst is not used by the desirable example.

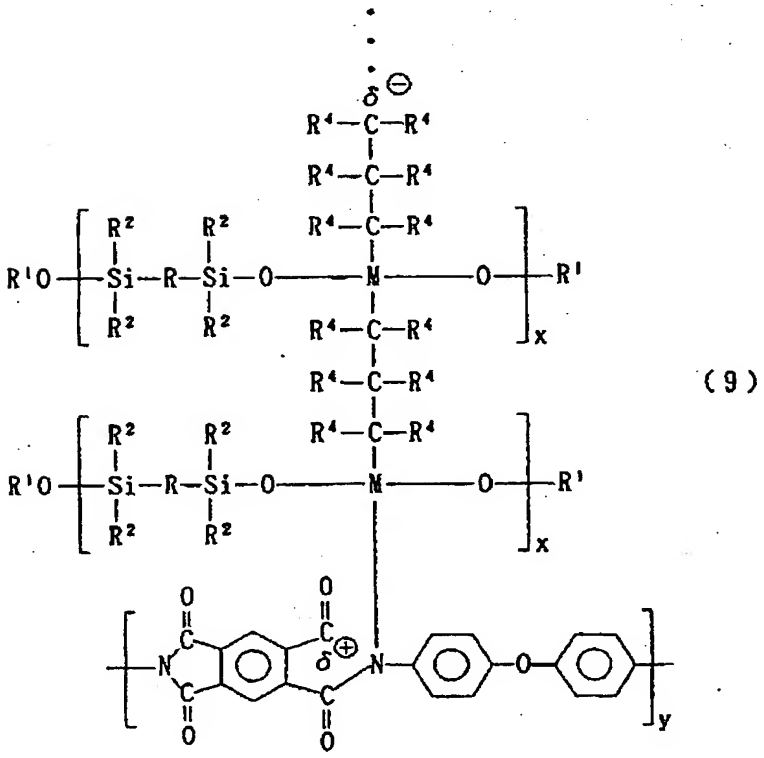
By the desirable example, the permutation aromatic compound of a formula 1 is a disilyl substituted compound, and the most desirable thing is bis(hydroxy dimethylsilyl) benzene. The METARO cyclobutane of a formula 2 is desirable and 1 and 1-dichloro-1-silacyclobutane is the most desirable including silicon. But the condensation product of the formula 4 formed from the compound of the desirable formula 1 and a formula 2 is formed into heat bridge formation in about 15 - about 30 minutes at the temperature of about 170 to about 210 degrees C. If 1, 1-dichloro-3, 3-dimethyl-1, and 3-disilacyclobutane is used instead of 1 and 1-dichloro-1-silacyclobutane in order to make the oligomer of a formula 4, crosslinking bond temperature can be lowered to 80-100 degrees C.

The molecular weight of the product of a formula 4 is adjusted as it is in the range of the liquid oligomer of about 1000 to about 30,000, and probably, as a result, this liquid oligomer has sufficient low viscosity to fill the gap between electric conduction material and a dielectric base material. The condensation product of the formula 4 which forms a liquid polymer is separated from a solvent by the technique used ordinarily.

As the ring breakage of a METARO cyclobutane ring arisen if Heat H is given to the liquid polymer of a formula 4 so that it may see in order of the following reactions, and the crosslinking bond of an ingredient arisen via the intermediate field of amphipathy and shown in a formula 6, it may graft-ize to a polymer nature base, for example, polyimide.


(5)
ΔH
(6)
(7)





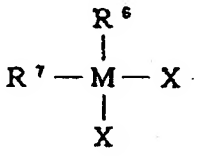
A catalyst is not required in order to carry out ring breakage of the cyclobutane ring. It is thought that a crosslinking bond is produced according to the chemical operation between the positive edges and the negative edges as for which one molecule carried out ring breakage now [of a formula 6] which it is on [of one of the formulas 6] a molecule although ring breakage was carried out. The formula 7 shows the bridge formation to which the crosslinking bond only of the two molecules is carried out. Carrying out the crosslinking bond of the three dots in two places of a formula 7 further with the molecule of a formula 6 is shown. The conclusion of the polymerization chain of the amphipathy intermediate field of a formula 6 occurs, when the polymer which the formula 7 bridge-formation-ized graft-izes to the base material in which it is carrying out deposition. In a desirable example, a base material is a

polymer and polyimide most preferably. When a polyimide ingredient gives heat, it contains the imide of the functionality which can carry out ring breakage. As shown in a formula 8, the polymer which the deposition of the polymer of a formula 6 was carried out on PMDA-ODA polyimide, and carried out the crosslinking bond to the nitrogen atom in the imide in which carried out ring breakage of the imide ring of polyimide so that the structure of a formula 9 might be produced, and polyimide carried out ring breakage here when being heated in order to construct a bridge in the polymer of a formula 6 is graft-ized. About 210 degrees C is enough as carrying out ring breakage of the imide ring of PMDA-ODA.

Limitation is not carried out for polyimide to PMDA-ODA (PIROMERAIKUJIANHIDORA id oxy-dianyline). Various kinds of polyimide ingredients including a homopolymer are explained to the term of the "polyimide" of The Encyclopedia of Chemical Technology, the 3rd edition, the 18th volume, and 702-719 page **, and this explanation is mentioned to reference.

Strengthening of adhesion of the RIE dirty barrier to a polymer base material is attained by processing a polymer base material with the steam plasma, before giving on it the liquid polymer which forms the RIE dirty barrier. The detail of the steam plasma use for promoting adhesion of the 1st and 2nd polymer layers can be seen during the United States patent application of Chou Mr. others entitled "adhesive strengthening on the front face of a polymer by steam plasma treatment" for which it applied on April 13, 1989, and mentions this explanation to reference.

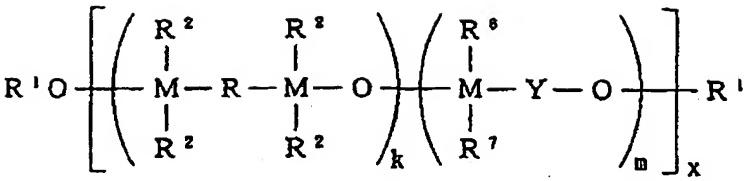
Extent of a crosslinking bond is controllable by adjusting the amount of the cyclobutane radical in the oligomer of a formula 5 by permuting a cyclobutane radical by the nonresponsive radical of other two organic functions. This can be attained by adding n mols of the compound which has a deHCl agent, k mols of compounds of a formula 1, p mols of compounds of a formula 2, and the following structure



(10)

expressions to a solvent. :

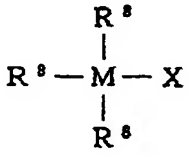
M is the thing of a pre- definition here and R6 and R7 are chosen from the group of alkyl and an alkenyl radical. What was obtained is a terpolymer shown in a formula 11, and Y is one of the divalent radicals of a formula 2 here.



(11)

Probably, the ratio of adjust [with the concentration of each component used for making the compound of a formula 11] of k to p pair m will be clear for this contractor. For example, k= 10, p= 10, and m= 1 are things when one mol of ten mol [of bis(hydroxy dimethylsilyl) benzene], ten mol [of dimethyl dichloro sills], 1, and 1-dichloro-1-silacyclobutane reacts in the solvent containing the pyridine as a deHCl agent.

If one end OR of formulas 6 and 11 uses the excessive amount of 1 organic-functions monomer which has the following structure expression in the start reaction mixture for making the thing of the structure of a formula 5 and a formula 11, a thoria reel silyl

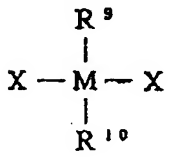


(12)

radical can permute it. :

M and X are defined in front and R8 is chosen from the group of aryl and an alkyl group. But desirable 1 organic-functions monomer is trimethylchlorosilane.

The component of the cross-linking of the polymer of a formula 5 and a formula 11 is a METARO cyclobutane ring. The vinyl content compound of a formula 10 and a formula 3 can be transposed to a METARO cyclobutane as a bridge formation-ized agent. This vinyl compound has the following structure expression. :

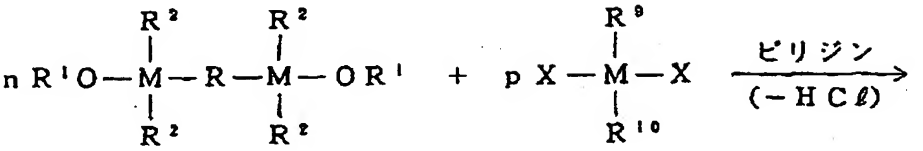


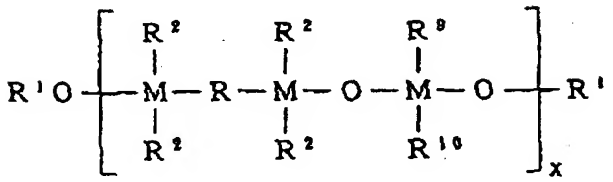
(13)

At least one of R9 and the R10 is at least one carbon carbon duplex association and an alkenyl radical which contains an ETEREN radical most preferably here. The remainder can be made into alkyl or an aryl group supposing one of R9 and the R10 includes carbon carbon duplex association.

As shown in the following reaction formulae, the compound of the formula 13 of an equimolecular amount is mostly combined with the compound of a formula 1 in the

solvent containing a deHCl agent.

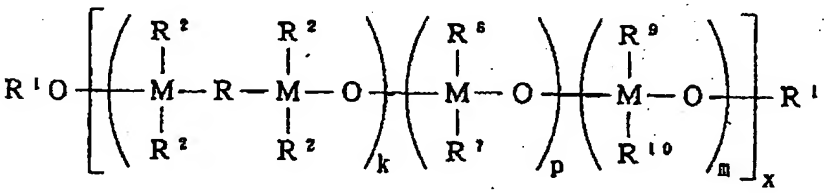




(14)

The product of a formula 14 is equivalent to the formula 5 with the cyclobutane ring permuted by the vinyl content radical of a formula 13, and R, R1, R2, R9, R10, and M are defined before here.

A formula 15 is equivalent to the formula 11 with the cyclobutane ring permuted by the vinyl content radical of a formula 13, and is described here before R, R1, R2, R6, R7, R9, R10, M, k, p, and m.

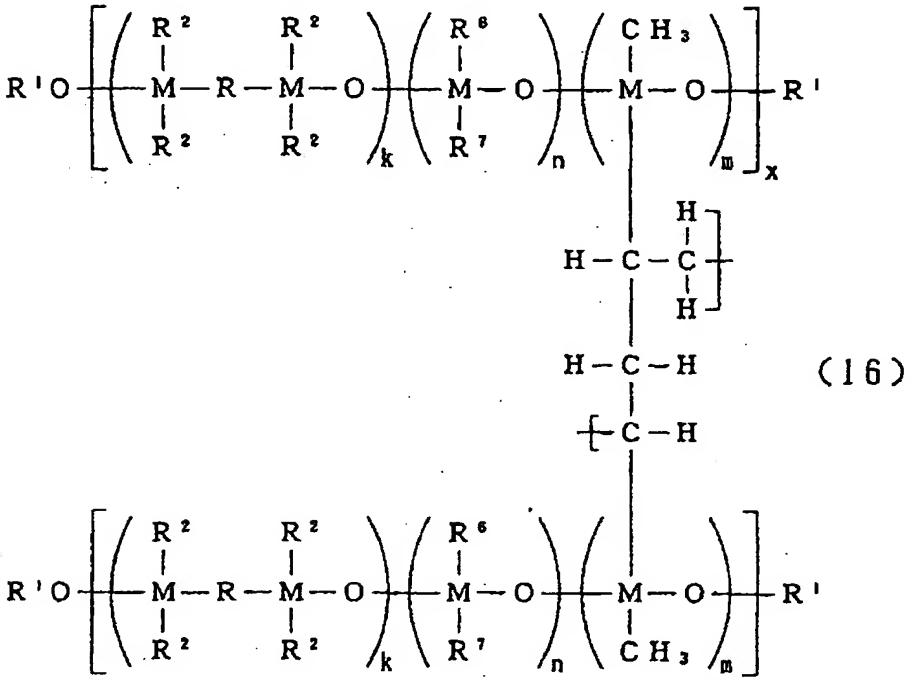


(15)

In order to open carbon carbon duplex association, generally either a photoinitiator or a heat initiator is needed for bridge formation-ization of the polymer of a formula 14 and a formula 15. One example of a radical character photoinitiator is an IRUGA cure (Ciba-Geigy make), and is added in the amount to 10% of the weight of the polymer of a formula 14 and a formula 15. The mixture of the polymer of a formula 14 or a formula 15 and a radical photoinitiator is exposed with light with a wavelength of 248nm, when an IRUGA cure is used as a photoinitiator. On the other hand, a heat initiator needs heating, in order to open carbon carbon duplex association of vinyl. The example of a heat initiator is azobisuisobutironitoriru (made in Aldrich Chemical), or azobisisobutyronitril, and this needs heating of about 60 degrees C or more in order to carry out the polymerization of the carbon carbon duplex association.

As for the following formulas 16, R9 show the product in which the formula 15 in case

ethylene and R10 are methyl groups carried out the crosslinking bond. In a desirable example, the compound of a formula 15 is vinyl containing sill phenylene siloxane oligomer.



(16)

The ingredient of formulas 5, 11, 14, and 15 can be used as a RIE barrier layer. the component which the component of organic nature oxidizes to an volatile thing, and does not volatilize when it hits against the oxygen content plasma -- the oxide of M, for example, diacid-ized silicon, -- it comes out and remains (when required, etching in the fluorine content plasma can remove this). all of these ingredients are high -- it has thermal and thermal oxidation stability. For example, R1 shows hydrogen and R2 shows the result of a value, as for methyl and M, for a polymer to have Si, and for a divalent phenyl group and R4 have molecular weight 5000 in methyl and R, as for t, and the thermogravimetric analysis (TGA) of ****** here [the disilyl phenylene silacyclobutane polymer and here] where the formula 7 carried out the crosslinking bond all over the 11th Fig. A shaft 40 is weight % and a shaft 42 is a Celsius degree. A curve 44 shows heating of the sample in the inside of nitrogen-gas-atmosphere mind, and the curve 46 shows heating of the sample in the inside of an oxygen ambient atmosphere. Until after a polymer is heated by about 500 degrees C or more in heating in nitrogen, there is no change which can be accepted in a polymer. About the sample heated in air, there is no change remarkable in a polymer until it is heated by about 400 degrees C or more. A remarkable change is not produced until the compound

described here as dirty barrier is generally heated by 350 degrees C or more.
Fig. 12 shows the etching result of the thing of sandwich structure. The polymer at the time of the TGA data of Fig. 11 was inserted between two PMDA-ODA polyimide layers. BEKU [this sandwich structure object / 360 degrees C] in order to harden the whole polyimide layer.
:polyimide layer from which R, R1, R2, R4, R5, R6, R7, R9, and R10 are defined below by this desirable example was 2micro, respectively, and the silyl phenylene layer was 0.6micro. Etching is O2-/CF4 (CF42%) plasma. The shaft 48 of Fig. 12 is the etch rate expressed with the angstrom per minute, and the shaft 50 shows the etching data in the etching time expressed with the part. A curve 52 corresponds to etching as a function of time amount, and a curve 54 is the laser interferometer measured value for measuring an etch rate. The distance between two peaks of a curve 54 is 2000A as shown all over drawing. The dirty ratio between the dirty barrier expressed in the polyimide expressed in an area 56 and an area 58 is about 20:1. :R by which R, R1, R2, R4, R5, R6, R7, R9, and R10 are defined below by this desirable example is phenylene and the most desirable divalent phenyl group preferably.;
R1 -- desirable -- the low-grade alkyl of H or C 1-10, the most desirable aryl in which H;R2 has the low-grade alkyl of C 1-10 and the alkenyl, and the 1-3 benzene rings preferably, and a siloxy radical -- most -- desirable -- methyl;
the aryl in which R4 has the low-grade alkyl of H and C 1-10 and the alkenyl, and the 1-3 benzene rings preferably, and a silyl radical -- most -- desirable -- methyl;
the aryl in which R5 has the low-grade alkyl of H and C 1-10 and the alkenyl, and the benzene ring of 1-3 preferably -- most -- desirable -- methyl;
the aryl in which R6, R7, and R9 have the low-grade alkyl of C 1-10 and the alkenyl, and the 1-3 benzene rings preferably -- most -- desirable -- methyl;
R10 -- desirable -- the low-grade alkenyl of C 1-10 -- most -- desirable -- ethylene.
Fruit ** Example example 122.6g p (screw-hydroxy dimethylsilyl) benzene was dissolved into 200ml toluene, the 32g piperidine was added, and, subsequently to the bottom of stirring, 19.1g 1 and 1-dichloro-1-silacyclobutane was added at the room temperature in this solution. The reaction mixture was ** Passed in order to remove precipitation (a pyridine and HCl salt) 17 hours after (at 20 degrees C), and subsequently to the inside of a methanol (10% H2O), it was poured. The lower layer poly sill phenylene copolymer was separated, in order to remove all volatile compounds, it held under the vacuum (150mm, 100 degrees C, 2 hours), and it ** Passed, and was used as dirty barrier. Molecular-weight (2 being GPC data 2-104) dispersibility, 2.00. The etch rate in O2 (CF4) plasma was a part for 60A/in 200m torr

including these oligomer about 28.6% of Si. Not producing decomposition to 400 degrees C by TGA data was shown.

Example The example 1 was repeated instead of 21 and 1-dichloro-1-silacyclobutane except 1, 3-dichloro-1, 3-dimethyl-1, and 3-JISHIRU cyclobutane having been used.

Example The example 1 was repeated instead of 31 and 1-dichloro-1-silacyclobutane except 1, 1-dichloro-3, 3-dimethyl-1, and 3-disilacyclobutane having been used.

Example The example 1 was repeated instead of 41 and 1-dichloro-1-silacyclobutane except the 1, 1-dichloro-2, and 3-benzo-1-silacyclo butene having been used.

Example The example 1 was repeated instead of 51 and 1-dichloro-1-silacyclobutane except 1 and 1-dichloro-3-methyl-1-silacyclobutane having been used.

Example The example 1 was repeated instead of 61 and 1-dichloro-1-silacyclobutane except 1, 1-dichloro-2-phenyl-1, and 1-silacyclobutane having been used.

Example The example 1 was repeated instead of 71 and 1-dichloro-1-silacyclobutane except 1, 1-dichloro-3, 3-diphenyl-1, and 3-disilacyclobutane having been used.

Example The example 1 was repeated instead of 81 and 1-dichloro-1-silacyclobutane except the 1 and 1-dichloro-1-germanium cyclobutane having been used.

Example The example 1 was repeated instead of 91 and 1-dichloro-1-silacyclobutane except the 1, 1-dichloro-3, and 3-dimethyl-1-Syros-3-germanium cyclobutane having been used.

Example The example 1 was repeated except p (screw-hydroxy-dimethylsilyl benzene) (22.6g), dimethyldichlorosilane (12.9g) and 1, and 1-dichloro-1-silacyclobutane having been used combining the mixture of the 10th three components, and a pyridine (32g).

Example Instead of 11 pyridines, except that triethylamine was used, the example 10 was repeated. Reaction time was 60 minutes.

Example The example 1 was repeated except that the mixture, p (screw-hydroxy dimethylsilyl) benzene (27.6g), dimethyldichlorosilane (12.9g), 1, and 1-dichloro-1-silacyclobutane (1.41g) and trimethylchlorosilane (the molecular weight modifier, 1g) of the 12th four components were used.

Example Diethylether was used as 13 solvents and the example 1 was repeated except having been removed at 50 degrees C (reduced pressure of 150mmHg, 2 hours).

Example Spin spreading of the oligomer of 14 examples 1 was carried out on the front face of the imide-ized polyimide (pie leren 5878 of Du Pont). After baking for 60 minutes at 170 degrees C, what carried out the crosslinking bond was formed.

Although this invention is indicated and the desirable example is explained, this

invention is not limited to the clear configuration described here, and a right is suspended also to all deformation and amelioration that are within the limits of this invention defined by the claim.

As mentioned above, although this invention was explained to the detail, this invention can summarize and show this according to the following embodiment further.

1) Consisting of dielectric object; and polymer ****; embedded to this dielectric inside of the body, this polymer **** contains a part for the fragrance configuration containing at least one of Si and the germanium atoms.;

This polymer **** contains the bridge formation-ized agent chosen from the group of one sort or several sorts of metal cyclobutane radicals, and a metal vinyl group.;

This cyclobutane radical and this vinyl group are the structure which is a thing containing at least one of Si and the germanium.

2) this dielectric body was embedded into it -- electric -- the structure given in the preceding clause 1 which is what contains a conductor further.

3) this -- electric -- the structure given in the preceding clause 2 with which a gap exists between the at least 1 section of a conductor, and this dielectric object, and this gap is filled up by the one section of this polymer **** on parenchyma.

4) This dielectric object is the structure given in the preceding clause 1 which is a polymer ingredient.

5) This polymer ingredient is the structure given in the preceding clause 4 which is polyimide.

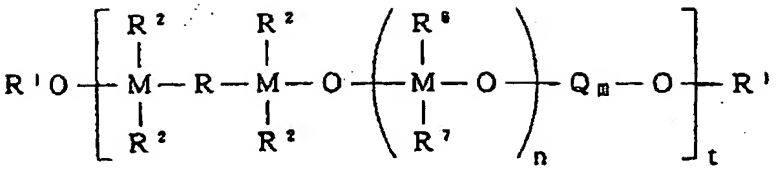
6) Paste up this dielectric object on this polymer **** and a chemistry target. The structure given in the preceding clause 1.

7) this -- electric -- the structure given in the preceding clause 2 as which a conductor is chosen from the group which consists of Au, Ag, Mo, aluminum, Cu, Cr, Co(es), and these alloys.

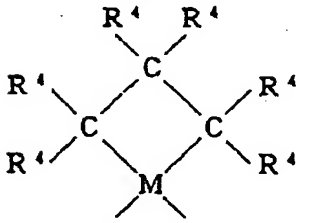
8) This polymer **** is the structure given in the preceding clause 1 which is the layer embedded to this dielectric inside of the body.

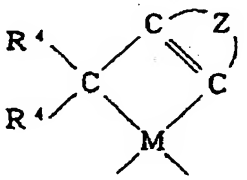
9) this -- electric -- a conductor -- the structure given in the preceding clause 2 which is what contains further the electronics components electrically connected to the inner conductor pattern.

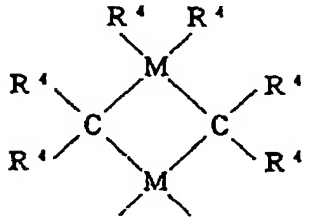
10) A compound with the following structure expressions carries out the crosslinking bond of this polymer ****. The structure given in the preceding clause 1.

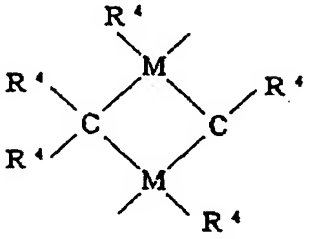


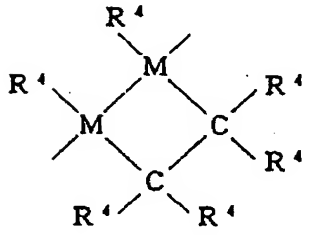
It is here and Q is the following structure expressions.

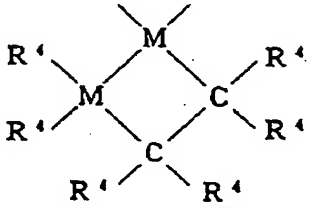


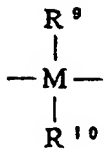




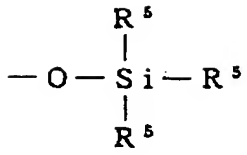




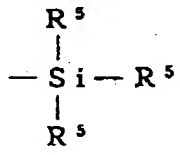




It is chosen out of the group of ****** and :R is a divalent aromatic series radical.; R1 is chosen from the group which consists of H, alkyl, aryl, and an alkenyl radical.; every -- R2 -- an alkyl group, an aryl group, an alkenyl radical, and the following

structure expressions 

it chooses out of the group which consists of a ** siloxy radical -- having -- : -- every -- R4 -- H, an alkyl group, an aryl group, an alkenyl radical, and the following

structure expressions 

it chooses out of the group which consists of a ** silyl radical -- having -- : -- here -- every -- R5 is chosen from the group which consists of H, alkyl, aryl, and an alkenyl radical -- having --;

R6 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;

R7 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;

R9 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;

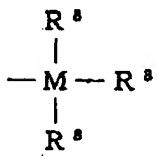
R10 is chosen from the group of the alkenyl.;

Z was chosen from the group which consists of an aromatic series radical, and Z forms the ring of 6 members which two R4 combined.;

M is chosen each from the group which consists of Si and germanium.;

;m is at least 1, t is a number for a compound to come to have about 1000 - about 30,000 molecular weight, and they are [; and n are equal to 0, or] a larger number than this.

11) The structure given in the preceding clause 2 which is what is permuted by the radical in which one end OR of this compound has the following structure expressions.



R8 is chosen from alkyl and an aryl group here.

12) R is the structure given in the preceding clause 10 chosen from the group which consists of phenylene, naphthalene, anthracene, ADAMANCHIN, a divalent ferrocene, and a divalent carborane radical.

Polymer **** 13) 1 and 1-dichloro-1-silacyclobutane, 1, 3-dichloro-1, 3-dimethyl-1, 3-disilacyclobutane, 1, 1-dichloro-3, 3-dimethyl-1, 3-disilacyclobutane, 1, 1-dichloro-2, 3-benzo-1-silacyclo butene, 1, and 1-dichloro-3-methyl-1-silacyclobutane, 1 and 1-dichloro-2-phenyl-1-silacyclobutane, 1, 1-dichloro-3, 3-diphenyl-1, 3-disilacyclobutane, a 1 and 1-dichloro-1-germanium cyclobutane and 1, 1-dichloro-3, and 3-dimethyl-1-Syros-3-germanium cyclobutane -- since -- with at least one chosen from the becoming group The structure given in the preceding clause 1 which is a resultant with p (screw-hydroxy dimethylsilyl) benzene.

14) Polymer **** is the structure given in the preceding clause 1 which is the resultant of p (screw-hydroxy-dimethylsilyl) benzene, dimethyldichlorosilane and 1, and 1-dichloro-1-silacyclobutane.

15) Polymer **** is the structure given in the preceding clause 1 which is the resultant of p (screw-hydroxy-dimethylsilyl) benzene, dimethyldichlorosilane, 1, and 1-dichloro-1-silacyclobutane and trimethylchlorosilane.

16) Prepare the 1st layer of a dielectric ingredient.;

On this ingredient layer, it processes with the liquid polymer nature ingredient containing a constituted part of aromaticity containing at least one of Si and the germanium atoms.;

This liquid polymer nature ingredient contains the bridge formation-ized agent chosen from the group of one sort or several sorts of metal cyclobutane radicals, and a metal vinyl group.;

This metal cyclobutane ring and this vinyl group contain at least one of Si and the germanium atoms.;

The crosslinking bond of this liquid polymer is carried out.;

The 2nd dielectric layer is arranged on this bridge-formation-ized liquid polymer.;

this -- the 1st -- and -- this --; on which a pattern shall be etched into with the plasma which contains oxygen for one of the 2nd dielectric layer, and this bridge-formation-ized polymer shall act as dirty barrier at this time

The creation approach of the structure which consists of things.

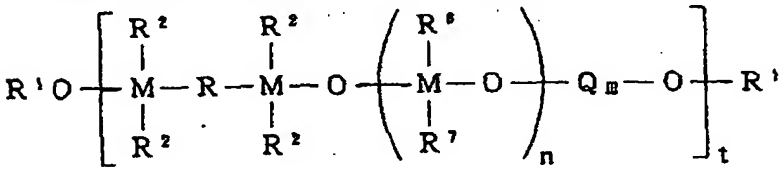
17) this -- the 1st -- and -- this -- as electric as at least one patternizing of the 2nd dielectric layer -- restoration of this pattern by the conductor -- further -- containing -- this liquid polymer nature ingredient -- this -- the 1st -- and -- this -- deposition is carried out to this pattern in at least one of the 2nd dielectric layer in it -- this -- electric -- an approach given in the preceding clause 16 which is what is filled up with the gap between conductors on parenchyma.

18) this -- the 1st -- and -- this -- an approach given in the preceding clause 16 whose at least one of the 2nd dielectric layer is a polymer ingredient.

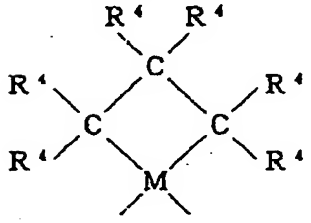
19) A polymer ingredient is an approach given in the preceding clause 16 which is polyimide.

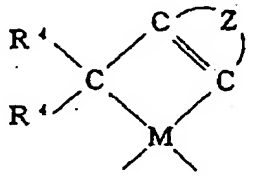
20) In advance of processing of this liquid polymer nature ingredient, this dielectric layer is an approach given in the preceding clause 16 which is what is processed by the steam plasma.

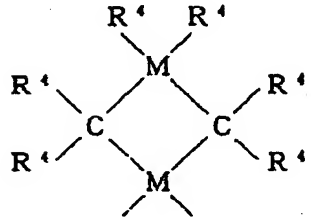
21) This liquid polymer nature ingredient is an approach given in the preceding clause 16 which is a thing with the following structure expressions.

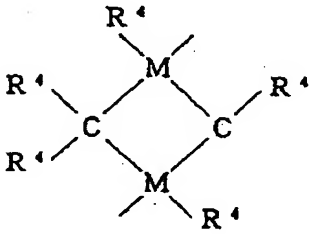


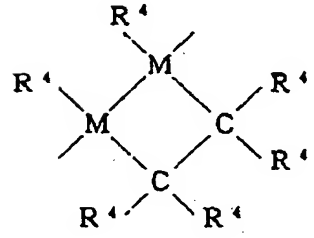
It is here and Q is the following structure expressions.

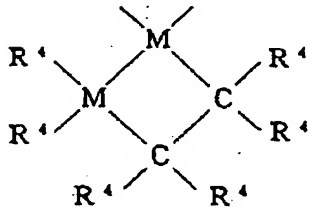


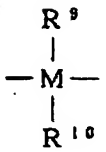




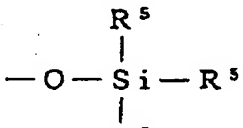






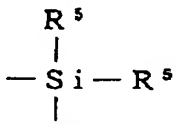


It is chosen out of the group of ******.;
R is a divalent aromatic series radical.;
R1 is chosen from the group which consists of H, alkyl, aryl, and an alkenyl radical.;
every -- R2 -- an alkyl group, an aryl group, an alkenyl radical, and the following



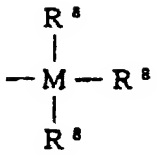
structure expressions

It is chosen out of the group which consists of a ** siloxy radical.;
every -- R4 -- H, an alkyl group, an aryl group, an alkenyl radical, and the following



structure expressions

It is chosen out of the group which consists of a ** silyl radical.;
every -- R5 is chosen from the group which consists of H, alkyl, aryl, and an alkenyl radical -- having --;
R6 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;
R7 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;
R9 is chosen from the group which consists of alkyl, aryl, and an alkenyl radical.;
R10 is chosen from the group of the alkenyl.;
Z is chosen from the group which consists of an aromatic series radical, two R4 joins together and Z forms the ring of 6 members.;
M is chosen each from the group which consists of Si and germanium.;
;m is at least 1, t is a number for a compound to come to have about 1000 - about 30,000 molecular weight, and they are [; and n are equal to 0, or] a larger number than this.
22) An approach given in the preceding clause 20 which is what is replaced by the radical in which one end OR of this compound has the following structure expressions.



R8 is an aryl group here.

A polymer nature ingredient 23) 1 and 1-dichloro-1-silacyclobutane, 1, 3-dichloro-1, 3-dimethyl-1, 3-disilacyclobutane, 1, 1-dichloro-3, 3-dimethyl-1, 3-disilacyclobutane, 1, 1-dichloro-2, 3-benzo-1-silacyclo butene, 1, and 1-dichloro-3-methyl-1-silacyclobutane, 1 and 1-dichloro-2-phenyl-1-silacyclobutane, 1, 1-dichloro-3, 3-diphenyl-1, 3-disilacyclobutane, At least one chosen from the group which consists of a 1 and 1-dichloro-1-germanium cyclobutane and 1, 1-dichloro-3, and 3-dimethyl-1-Syros-3-germanium cyclobutane An approach given in the preceding clause 16 which is a resultant with p (screw-hydroxy dimethylsilyl) benzene.

24) This polymer nature ingredient is an approach given in the preceding clause 16 which is the resultant of p (screw-hydroxy dimethylsilyl) benzene, dimethyldichlorosilane and 1, and 1-dichloro-1-silacyclobutane.

25) This polymer nature ingredient is an approach given in the preceding clause 16 which is the resultant of p (screw-hydroxy dimethylsilyl) benzene, dimethyldichlorosilane, 1, and 1-dichloro-1-silacyclobutane and trimethylchlorosilane.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

Fig. 1 shows the dielectric layer which has a through tube in it.

Fig. 2 shows the electrical conductivity layer arranged on the structure of Fig. 1 .

Fig. 3 shows the electrical conductivity layer etched to the up front face of a dielectric layer.

Fig. 4 shows the structure of Fig. 3 with the layer of the ingredient which forms the RIE dirty barrier by this invention.

Fig. 5 shows the structure of Fig. 4 with the dielectric layer arranged on the RIE dirty barrier of Fig. 4 .

Fig. 6 shows alternative removal of the 2nd dielectric layer of Fig. 5 .

Fig. 7 shows the RIE dirty barrier removed at the pars basilaris ossis occipitalis of the

location where the 2nd dielectric layer was removed.

Fig. 8 shows the electrical conductivity layer by which deposition was carried out on the structure of Fig. 7 .

Fig. 9 shows the electrical conductivity layer of the structure of Fig. 8 etched to the up front face of the 2nd dielectric layer.

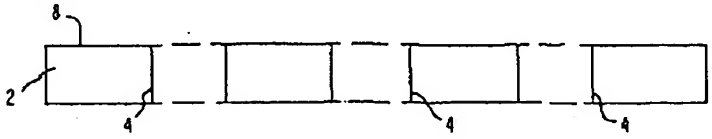
Fig. 10 is one enlarged drawing of the electric conduction material in the structure of Fig. 4 , and it is shown that the dirty barrier ingredient of polymer nature is filling the inside of the gap between electric conduction material and the 1st dielectric layer.

Fig. 11 is the thermogravimetric analysis plot of the polymer for RIE dirty barrier of this invention.

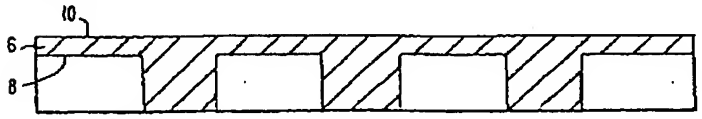
Fig. 12 is the plot of the etch rate of the polymer of Fig. 11.

DRAWINGS

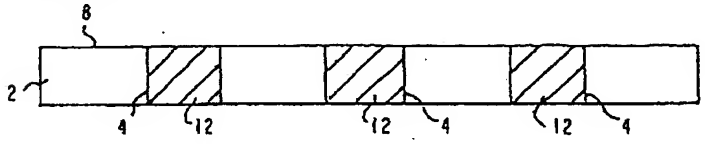
[Fig. 1]



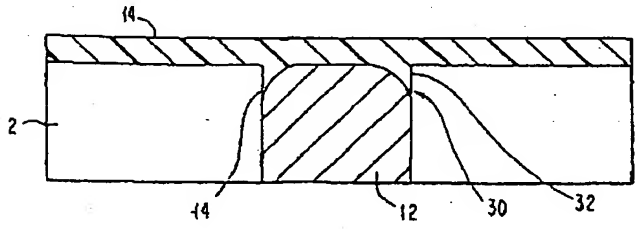
[Fig. 2]



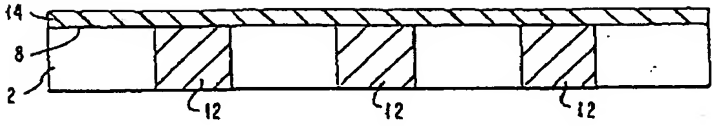
[Fig. 3]



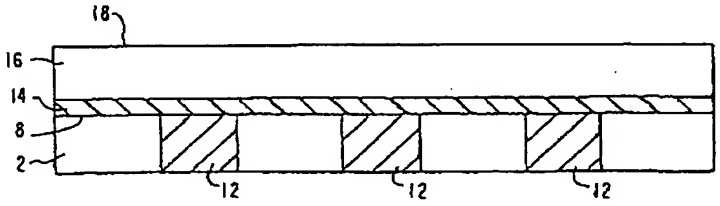
[Fig. 10]



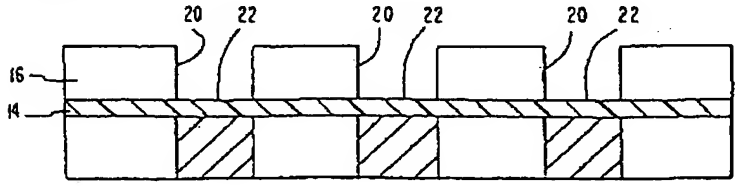
[Fig. 4]



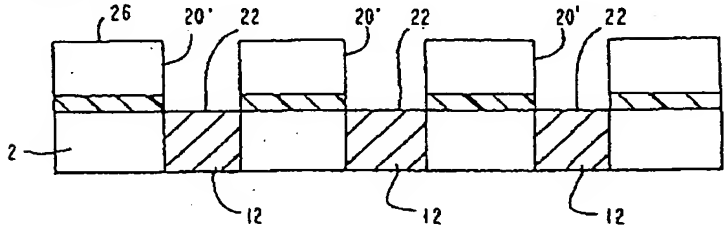
[Fig. 5]



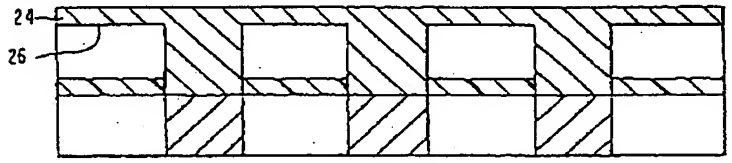
[Fig. 6]



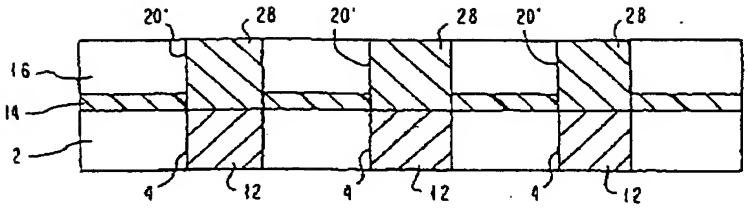
[Fig. 7]



[Fig. 8]



[Fig. 9]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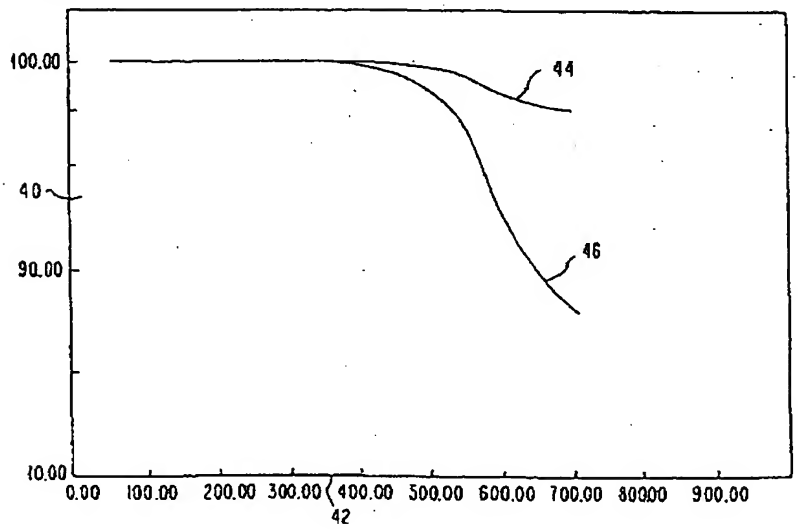
[Fig. 11]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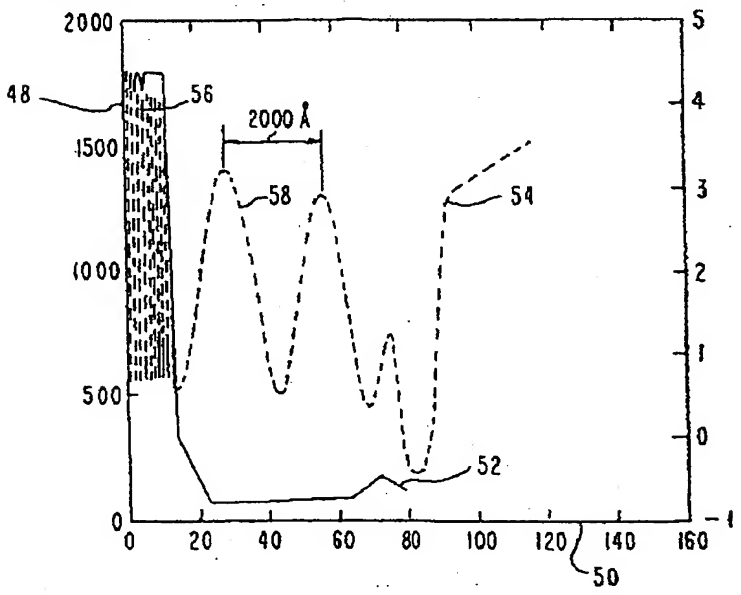
[Fig. 12]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